Computer Graphics
(600.457/657)

Prof. Misha Kazhdan
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Outline

• Introduction
• Syllabus
• Coursework
• Miscellaneous
Introduction: What is CG?

- 2D image processing
- 3D object representation & manipulation
- Simulating physical processes & materials
- Animating any of the above
Introduction: What is CG?

2D image processing

- 3D object representation & manipulation
- Simulating physical processes & materials
- Animating any of the above

http://paulbakaus.com/
Introduction: What is CG?

- 2D image processing
- 3D object representation & manipulation
  - Simulating physical processes & materials
  - Animating any of the above

“Incredibles 2” Disney / Pixar
Introduction: What is CG?

- 2D image processing
- 3D object representation & manipulation
- Simulating physical processes & materials
- Animating any of the above

Gringold et al. 2004
Introduction: What is CG?

- 2D image processing
- 3D object representation & manipulation
- Simulating physical processes & materials
- Animating any of the above (4D)

Team Fortress 2: Meet the Heavy, Valve
Introduction: What is CG?

“You know it when you see it…”

http://www.creativecrash.com/tutorials/
Introduction: What is CG?

“You know it when you see it… maybe.”

http://www.creativecrash.com/tutorials/
Introduction: Applications

• Entertainment
• Computer Aided Design
• Scientific Visualization
• Training & Education
Introduction: Applications

Entertainment

• Computer Aided Design
• Scientific Visualization
• Training & Education

“How to Train Your Dragon 2”
DreamWorks

“Gears of War 4”
The Coalition
Introduction: Applications

- Entertainment
- Computer Aided Design
- Scientific Visualization
- Training & Education

Completely virtual model built in 3D:
- Shorten the development period
- Shorten the learning curve
Introduction: Applications

- Entertainment
- Computer Aided Design
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- Training & Education

Flow Visualization
Roettger et al.

Neutron Star Collision
Courtesy of David Bock

Aspirin in RasMol
Courtesy of Michael Friendly

The Visible Human
Courtesy of NLM
Introduction: Applications

- Entertainment
- Computer Aided Design
- Scientific Visualization

Training & Education

Microsoft Flight Simulator

Image courtesy of Agrawala et al.
Outline

• Introduction
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Syllabus

- Image Processing (2D)
- Ray Tracing (3D)
- Rendering (3D)
- Modeling (3D)
- Animation (4D)
Syllabus

• Image Processing
  ◦ Quantization and Dithering
  ◦ Sampling
  ◦ Filters
  ◦ Warping, Morphing, and Compositing
Syllabus

• Ray Tracing
  ○ Cameras
  ○ Primitives
  ○ Lights
  ○ Spatial Data Structures
  ○ Reflection, Transparency and Refraction

• Rendering
  ○ Coordinate Systems and Modeling Transformations
  ○ Viewing transformations
  ○ Shading
  ○ Textures
  ○ Visibility
  ○ OpenGL
Syllabus

• Modeling
  ◦ Triangles
  ◦ Splines
  ◦ Subdivision Surfaces
  ◦ Procedural Models
  ◦ Point Based Models

• Animation
  ◦ Key-Framing
  ◦ Kinematics
  ◦ Dynamics
Outline

• Introduction
• Syllabus
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Coursework

• NB: Lots of work!

• Exams (30%)

• Programming assignments (60%)

• Class participation (10%)
Coursework

• NB: Lots of work!

Exams (30%)
  ◦ Two exams
  ◦ Absolutely no excuses will be accepted for missing the exams. Not taking the exam at the scheduled time = 0!

• Programming assignments (60%)

• Class participation (10%)
Coursework

• NB: Lots of work!

• Exams (30%)

Programming assignments (60%)
  ○ Image Processing (15%)
  ○ Ray Tracing (15%)
  ○ OpenGL Rendering (15%)
  ○ Animation (15%)

• Class participation (10%)
Coursework

• NB: Lots of work!

• Exams (30%)

Programming assignments (60%)
  ◦ Knowledge of C/C++ assumed!
  ◦ Must be turned in by 23:59 on due date
  ◦ 5 late days (combined)
  ◦ Notify TA in your readme if you use a late day
  ◦ Otherwise, late assignments receive NO credit

• Class participation (10%)
Coursework: Collaboration Policy

• You must write your own code
• You must reference sources of ideas/code

• It’s okay to:
  ○ Discuss ideas with other students
  ○ Get ideas from books, web sites, etc.
  ○ Get “support code” from books, web, etc.
    » REFERENCE IT

• It is not okay to:
  ○ Share code with other students
  ○ Copy code from other students
  ○ Use ideas or code from other sources without attribution
Coursework

• NB: Lots of work!

• Exams (30%)

Programming assignments (60%)

• Class participation (10%)

Bottom line:
If you don’t LOVE programming, don’t take this class!
Coursework

• NB: Lots of work!
• Exams (30%)
• Programming assignments (60%)
• Class participation (10%)
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Miscellaneous

- Course web page:
  - http://www.cs.jhu.edu/~misha/Fall18

- Piazza page:

- No required text book.
  - Additional reading:
    - *Computer Graphics: Principles and Practice in C*
      Foley, van Dam, Feiner, and Hughes
      Neider, Davis, and Woo
    - *Fundamentals of Computer Graphics* Shirley

- Will **not** cover GPU programming (e.g. shaders)
Miscellaneous

- Teaching/Course Assistants:
  - Sing Chun Lee
  - Steve Zhao

- Office hours:
  - Mine: Monday 2:00 – 3:00 @ Malone 229
  - Sing Chun’s: Friday 9:00-9:55 @ Malone 216
  - Steve’s: TBD

- Keeping in touch:
  - Email: cs457@cs.jhu.edu
  - Note:
    - Do not send code snippets.
    - Do not ask us if your implementation is correct.
Assignment 1:

- Image Processing
- Due September 27 @ 11:59 pm
- Even if you won't start working on the code until later, download it and try compiling ASAP to make sure that things are correctly set up on your system.